MONITORING PLAN
PROJECT NO. T/V-12 (PTV-19)
LITTLE VERMILION BAY SEDIMENT TRAPPING

November 16, 1998

Project Description

Little Vermilion Bay is a shallow western extension of Vermilion Bay, located in south-central Vermilion Parish, Louisiana (figure 1). Prior to 1900, marshes surrounding Little Vermilion Bay were brackish or saline. By 1952, fresh water from the Atchafalaya Basin began reaching Atchafalaya Bay and reduced salinities in the area (Adams and Baumann 1980). With strong southeasterly winds, sediment-rich waters from Atchafalaya Bay reach Little Vermilion Bay and deposit sediments in the proposed project area.

Perhaps the most important hydrologic change within this region was the dredging of the Gulf Intracoastal Waterway (GIWW). Construction of the Gulf Intracoastal Waterway (GIWW) was authorized by the Rivers and Harbors Act of 1925 [Louisiana Coastal Wetlands Conservation and Restoration Task Force (LCWCRTF) 1993]. Recent studies, involving satellite imagery and turbidity meters, indicate that northwest winds (resulting from cold fronts) are largely responsible for re-suspending sediments in Little Vermilion Bay and that the GIWW and Freshwater Bayou are significant sources of fresh water and sediment into the area (Walker 1998). Sediment availability is of fundamental importance to the project. The recognition of the potential for subaerial development in Little Vermilion Bay stimulated interest in designing a plan to enhance this development (National Marine Fisheries Service [NMFS] 1998).

At mean tide levels, water depth in Little Vermilion Bay ranges from 1 to 3 ft (0.3 - 0.9 m). Soil types surrounding Little Vermilion Bay are classified as Clovelly-Lafitte (Natural Resources Conservation Service [NRCS] 1996). Clovelly soils consist of continuously flooded, very poorly drained, and very slowly permeable organic matter formed in moderately thick accumulations of herbaceous plant material, overlying very fluid clayey alluvium (NRCS 1996). Lafitte soils consist of mostly flooded, very poorly drained, and moderately rapidly permeable, organic matter from herbaceous plant material, overlying clayey alluvium (NRCS 1996). Marshes surrounding Little Vermilion Bay have been classified as brackish by O'Neil (1949) and Chabreck and Linscombe (1968, 1978, 1988). Primary plant species include *Phragmites australis* (roseau cane), *Spartina patens* (saltmeadow cordgrass), *S. alterniflora* (smooth cordgrass), *Sagittaria* sp. (arrowhead), *Scirpus californicus* (giant bulrush), *Typha* sp. (cat-tail), *Juncus romerianus* (needle rush), and *Cladium jamaicense* (sawgrass) (nomenclature according to Godfrey and Wooten [1981a and 1981b]).

At present, no documented studies of wetland change nor coastal restoration activities have been conducted within Little Vermilion Bay. However, Vermilion Land Corporation constructed spoil terraces adjacent to the project area as a pilot study. Unpublished results indicated that after 13 months, while the unvegetated terraces eroded away, those that were vegetated actually were improving through growth and colonization of additional plants.

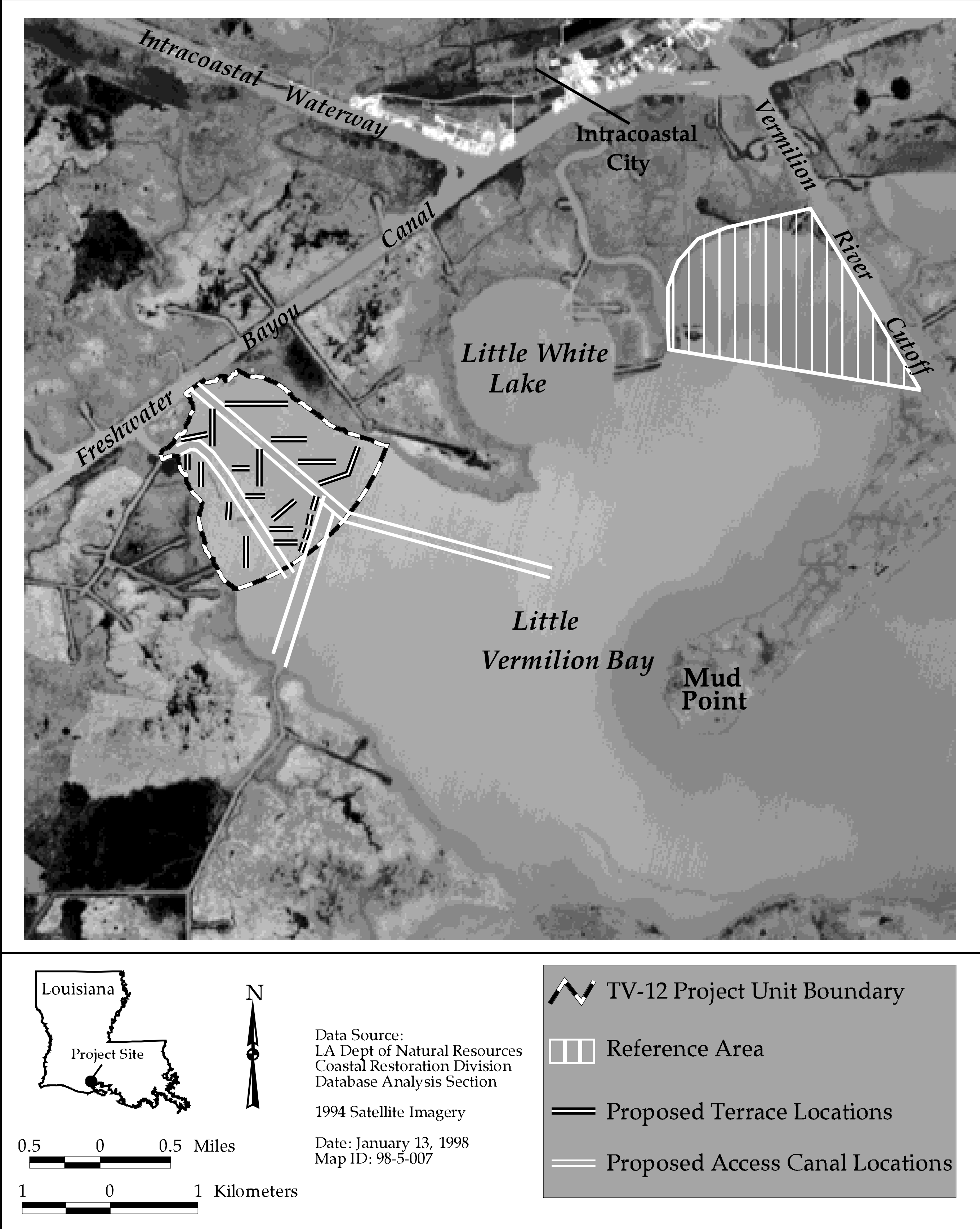

Figure 1. Little Vermilion Bay (T/V-12) sediment trapping project and reference area.

The Little Vermilion Bay Sediment Trapping Project area will affect 964 ac (390 ha), of which 67 ac (27 ha) are intermediate marsh and 897 ac (363 ha) are open water (figure 1). It is located in the northwestern corner of Little Vermilion Bay (29º 43' 00" N, 92º11' 00" W) at its intersection with Freshwater Bayou.

The project includes multiple features that would classify it not only as a sediment trapping project but also a vegetative planting and shoreline protection project. The features include:

1. Dredging 14,000 to 19,900 linear feet (4,267 - 6,065 m) of distributary channels 100 ft (30.5 m) wide and 10 ft (3.0 m) deep.
2. Creating 22 - 31 acres (8.9 - 12.5 ha) of terraces 23 - 27 ft (7 - 8 m) wide and 5.0 ft (m) above mudline.
3. Planting gallon containers and sprigs of *S. alterniflora* or other suitable species at the base of terraces and along the existing shoreline.

Plan Objectives

1. Enhance the amount of wetlands created by natural sediment deposition where confined flow of Atchafalaya River water enters the project area through the dredging of distributary channels.

2. Protect the existing wetlands of the project area by reducing wave energy through the creation of terraces.

3. Create emergent marsh on terraces along distributary channels and on newly deposited soils.

4. To encourage colonization by submerged aquatic vegetation between and around terraces.

Specific Goals

1. Increase sediment deposition in the project area conducive to the establishment of emergent vegetation.

2. Create and enhance emergent marsh by planting on terraces and along suitable existing shorelines.

3. Increase the occurrence of submerged aquatic vegetation in shallow open water within the project area.

4. Reduce shore erosion rate in the project area.

Reference Area

The importance of using appropriate reference areas cannot be overemphasized. Monitoring on both project and reference areas provides a means to achieve statistically valid comparisons, and is therefore the most effective means of evaluating project effectiveness. The main criteria for selecting a reference area are similarities in vegetative community, soil type, and hydrology, and proximity to the project area.

The reference area is approximately 3 mi (4.8 km) east of the project area and is classified as brackish and intermediate marsh. The project area is classified as brackish marsh (Chabreck and Linscombe 1988) and both areas are of the Clovelly-Lafitte soil series (NRCS 1996). Similar hydrological influences affect both areas. Specifically, the project area is directly exposed to Freshwater Bayou on the north and Little Vermilion Bay on the south. The reference area is open to the Vermilion River Cutoff on the northeast and Little Vermilion Bay on the southwest. However, the reference area is likely protected from winds generated from the southeast, whereas the project area is not. Therefore, comparisons of shoreline erosion rates between the project and reference areas will be interpreted with caution.

The proposed reference area will be used in the evaluation of SAV abundance and bathymetry/topography. A sampling scheme similar in proportion and technique will be used for both areas. Aerial photography will be flown for both project and reference areas.

Monitoring Plan Limitations

Although T/V-12 was classified as a sediment trapping project, it also contains vegetative plantings and shoreline protection components. The monitoring budget is insufficient to monitor all project components because monitoring allowances are constrained by project classification. Therefore, vegetative plantings will not be monitored.

Monitoring Elements

1. Aerial Photography — To document marsh to open-water ratios and marsh loss rates, color-infrared aerial photography (1:12,000) will be obtained in 1999 (prior to construction), 2002, 2009, and 2017. Habitat mapping is not required. However, imagery will be delineated to classify all land in the project and reference areas as either (1) preexisting wetlands, (2) terraces, and (3) non-terrace, newly developed wetlands (i.e., those that develop in open water areas between the terraces or adjacent to the preexisting shoreline). Otherwise, the photography will be analyzed with GIS by NWRC using procedures as outlined in Steyer et. al. (1995).

2. Hydrophytic Classification

The vascular plants that colonize the terraces will be evaluated and classified into a wetland indicator status based on a plant species frequency of occurrence in wetlands. The status will be obtained from the "National List of Wetland Plant Species That Occur in Wetlands: Louisiana" (Reed 1988). The five classifications to be used and their prevalence index values are obligate wetland (OBL=1), facultative wetland (FACW=2), facultative plants (FAC=3), facultative upland (FACU=4), and obligate upland (UPL=5). Data will be collected using line intercept methodology on a minimum of two and a maximum of four transects per terrace (dependent upon length), with samples taken at 3.28 ft (1 m) intervals. All plants that are in the vertical plane of the line will be identified, assigned a prevalence index number, and averaged for each 3.28 ft (1 m) segment. The number of segments with prevalence index values of 1, 2 or 3 on each terrace will be determined and a percentage of the total calculated. Measurements will be taken across the terraces from vegetated edge to vegetated edge and differential Global Positioning System (dGPS) readings will be taken for consistency of sampling area throughout each sampling year. Hydrophytic classification will be determined in 2002, 2004, 2009, and 2017.

3. Submersed Aquatic Vegetation

To document changes in the frequency of occurrence of submersed aquatic vegetation (SAV), a modification of the rake method will be employed (Chabreck and Hoffpauir 1962). The project and reference area will be monitored along 5 transects each divided into 3 blocks. Each block will have a minimum of 50 sampling stations. At each station, aquatic vegetation will be sampled by dragging a garden rake on the pond bottom for about 1 second. The presence of vegetation will be recorded to determine the frequency of aquatic plant occurrence (frequency = number of occurrences/number of stations x 100). When vegetation is present, the species present will be recorded in order to determine the frequencies of individual species (Nyman and Chabreck 1996). SAV abundance will be sampled in 1999 (pre-construction), and in 2004, 2009, and 2017.

4. Bathymetry/Topography

Sediment deposition will be monitored along existing transects used in bathymetry map creation (for engineering purposes). Several transects encompassing an array of terrace and channel formations will be selected for development of elevational profiles. Elevation of the water bottom sediments will be determined along each transect in a similar fashion to that in the initial survey. Surveys will be conducted by a professional engineering firm in 1999 (immediately post-construction), 2002, 2004, and 2009. Survey years may change to gather additional information earlier in the project life based on potential ineffectiveness of the project.

5. Shoreline Change — To document shoreline change in the project area, GPS surveys will be conducted at the vegetative edge of the bank to document the position of the shoreline in 1999 (pre-construction) and post-construction in 2004, 2009, and 2017. A similar survey will be conducted in the reference area. GPS shoreline positions will be mapped and used to measure shoreline movement over the life of the project.

<u>Anticipated Statistical Analyses and Hypotheses</u>

The following paragraphs describe statistical tests that will be used to analyze data collected for each monitoring element included in this monitoring plan to evaluate the accomplishment of the project goals. The numbers to the left correspond to the monitoring elements described above. These are followed by statements of the project goals, and the hypotheses that will be used in the evaluation.

1. Aerial Photography: Descriptive and summary statistics on historical data (for 1956, 1978, and 1988) and data from color-infrared aerial photography collected pre- and postconstruction will be used, along with GIS interpretations of these data sets, to evaluate marsh to open water ratios and changes in the rate of marsh loss/gain in the project area.

   Goal: Create and enhance emergent marsh in the project area.

   Hypothesis[1]:

   H_o^1: Post-construction marsh loss within the project area will not be significantly less than post-construction marsh loss within reference area.

   H_a^1: Post-construction marsh loss within the project area will be significantly less than post-construction marsh loss within reference area.

   Hypothesis[2]:

   H_o^2: Marsh loss within the project area after project implementation will not be significantly less than marsh loss before project implementation.

H_a^2: Marsh loss within the project area after project implementation will be significantly less than marsh loss before project implementation.

2. Submersed Aquatic Vegetation: Within a given sampling period, appropriate parametric and /or nonparametric methods will be used to test the following hypothesis.

Goal: Increase the occurrence of SAV's in shallow open water within the project area.

Hypothesis[1]:

H_o^1: Post-construction frequency of SAV in the project area is not significantly greater than the post-construction frequency of SAV in the reference area.

H_a^1: Post-construction frequency of SAV in the project area is significantly greater than the post-construction frequency of SAV in the reference area.

Hypotheses[2]:

H_o^2: Frequency of SAV in the project area after project implementation will not be significantly greater than the frequency of SAV before project implementation.

H_a^2: Frequency of SAV in the project area after project implementation will be significantly greater than the frequency of SAV before project implementation.

3. Bathymetry/Topography: Appropriate parametric and/or nonparametric methods will be used to test the following hypothesis.

Goal: Increase sediment deposition within the project area.

Hypothesis[1]:

H_o^1: Post-construction elevation of sediment between terraces in the project area will not be more than post-construction elevation of sediment in the reference area.

H_a^1: Post-construction elevation of sediment between terraces in the project area will be more than post-construction elevation of sediment in the reference area.

Hypothesis²:

H_o^2: Elevation of sediment between terraces in the project area after project implementation will not be significantly greater than elevation of sediment between terraces before project implementation.

H_a^2: Elevation of sediment between terraces in the project area after project implementation will be significantly greater than elevation of sediment between terraces before project implementation.

4. Shoreline Change: Descriptive and summary statistics will be used to compare measured rates of shoreline change in the project and reference area between successive years. Appropriate parametric and/or nonparametric methods will be used to test the following hypothesis.

Goal: Decrease the shoreline erosion rate in the project area.

Hypotheses: H_o: Shoreline retreat rate along the project area at time point i will not be significantly less than the shoreline retreat rate along the reference area at time point i (where i = 1, 2, 3).

i = 1 3 yr. 2005
i = 2 3 yr. 2010
i = 3 3 yr. 2017

H_a: Shoreline retreat rate along the project area at time point i will be significantly less than the shoreline retreat rate along the reference area at time point i.

Hypotheses: H_o: Shoreline retreat rate along the project area at time point i will not be significantly less than the shoreline retreat rate along the project area in previous years (where i = 1, 2, 3).

H_a: Shoreline retreat rate along the project area at time point i will be significantly less than the shoreline retreat rate along the project area in previous years.

<u>Notes</u>

1.	Implementation:	Start construction	February 1, 1999
		End construction	May 1, 1999
2.	NMFS Point of Contact:	Teresa McTigue	(318) 482-5915
3.	DNR Project Manager:	Clay Menard	(318) 893-3643

DNR Monitoring Manager:	Chad J. Courville	(318) 893-3643
DNR DAS Assistant:	Mary Horton	(504) 342-4122

4. The fully funded 20-year monitoring plan development and implementation budget for this project is $143,476. A progress report will be available in 2000, and comprehensive monitoring reports will be available in 2003, 2006, 2010, and 2019.

5. Flexibility of the Monitoring Plan: The sampling schedule may be altered to collect data following low frequency, high impact events such as drought, fire or storm. The decision to reschedule will depend on the utility of the information in assessing the need for project maintenance or modification. Altering the sampling schedule will require approval from the state and lead federal agency.

6. References:

Adams, R.D., and R.H. Baumann 1980. Emergence of the Atchafalaya Bay Delta. Louisiana Sea Grant Program, Louisiana State University, Baton Rouge, LA.

Chabreck, R.H., and C.M. Hoffpauir 1962. The use of weirs in coastal marsh management in coastal Louisiana. Proceedings of the Annual Conference of the Southeastern Association of Game and Fish Commisioners 16:103-112.

Chabreck, R.H., and R.G. Linscombe 1968. Vegetative type map of the Louisiana coastal marshes. Louisiana Wildlife and Fisheries Commission, Baton Rouge, LA.

——1978. Vegetative type map of the Louisiana coastal marshes. Louisiana Wildlife and Fisheries Commission, Baton Rouge, LA.

——1988. Vegetative type map of the Louisiana coastal marshes. Louisiana Wildlife and Fisheries Commission, Baton Rouge, LA.

Godfrey, R.K., and J. W. Wooten 1981a. Aquatic and Wetland Plants of Southeastern United States: Dicotyledons. Athens: University of Georgia Press.

—— 1981b. Aquatic and Wetland Plants of Southeastern United States: Monocotyledons. Athens: University of Georgia Press.

Louisiana Coastal Wetlands Conservation and Restoration Task Force (LCWCRTF) 1993. Coastal Wetlands Planning, Protection and Restoration Act, Louisiana Coastal Wetlands Restoration Plan: Main Report, Environmental Impact Statement and Appendices. Baton Rouge, La: U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Marine Fisheries

Service, Natural Resource Conservation Service, and Louisiana Department of Natural Resources.

Mendelssohn, I.A., and M.W. Hester 1984. Texaco USA Coastal Vegetation Project, Timbalier Island. Laboratory for Wetland Soils and Sediments, Center for Wetland Resources, Louisiana State University, Baton Rouge, LA. 128 pp.

National Marine Fisheries Service (NMFS) 1998. Little Vermilion Sediment Trapping Project, Vermilion Parish, La. Environmental Assessment. U.S. Department of Commerce (USDC), National Marine Fisheries Service. 36 pp.

Natural Resources Conservation Service (NRCS) 1996. Soil survey of Vermilion Parish, Louisiana. U.S. Department of Agriculture (USDA), Natural Resources Conservation Service. 183+ pp.

Nyman, J.A., and R.H. Chabreck 1996. Some effects of 30 years of weir management on coastal marsh aquatic vegetation and implications to waterfowl management. Gulf of Mexico Science 14:16-25.

O'Neil, T. 1949. The muskrat in the Louisiana marshes. Louisiana vegetation map. Louisiana Wildlife and Fisheries Commission, New Orleans, LA.

Ott, R. L. 1993. An Introduction to Statistical Methods and Data Analysis. Belmont, California: Wadsworth Publishing Company. 1051 pp.

Reed, P. B., Jr. 1988. National list for plant species that occur in wetlands: Southeast (Region 2). U. S. Fish and Wildlife Service Biological Report 88(26.2). 124 pp.

Steyer, G.D., R.C. Raynie, D.L. Steller, D. Fuller, and E. Swensen 1995. Quality Management plan for Coastal Wetlands Planning, Protection, and Restoration Act monitoring program. Open-file series no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division.

Walker, N. D. 1998. Personal communication. Baton Rouge: Louisiana State University.